

ART. X.—*On the Probable Environment of the Palaeozoic Genus Hercynella in Victoria.*

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The recent discovery¹ of the interesting gasteropod *Hercynella*, a supposed pulmonate or air-breathing mollusc, in the newer Silurian or Yeringian of the Upper Yarra district in Victoria, leads one to enquire into its mode of living. This enquiry may be conducted on two lines—viz., that of the nature of the sediment in which it occurs, and the other, regarding the fauna with which it is associated.

Before entering upon these questions, it will be well to consider the views of Marjorie O'Connell on this subject² in regard to the species of *Hercynella* occurring in the Waterlime Group (=Upper Ludlow) of North Buffalo, U.S.A., at what seems to be an identical horizon as the Victorian, so far as one can judge by associated faunas. Miss O'Connell's note on the "Habitat of *Hercynella*" (loc. cit. p. 100) is here given in full:—

"The horizon in Bohemia in which the largest number of *Hercynellas* has been found is F or Upper Monroan [Lower Devonian]. Here they are associated with vast numbers of graptolites, and also with sponges, trilobites and tentaculites. The fauna is undoubtedly marine, and since it is well-preserved, and the *Hercynellas* are also numerous and in good condition, there is no reason for questioning the marine habitat of the species of Bohemia. Furthermore, the shells are comparatively thick, showing no lack of carbonate of lime for impregnation. The one specimen from the Monroe limestone of Michigan likewise has good marine associates, though its macerated condition and the fact that no other specimens have been found would leave it an open question whether it was a true marine form or merely one swept out to sea by land waters. The *Hercynellas* which have been found in the Bertie waterlime, seem to indicate conditions other than marine, for their shells are exceedingly thin, as though available lime were not abundant in the water in which they lived, and, moreover, their faunal associates are not typical marine forms, there being only eurypterids, ceratiocarids and the

1 Proc. Roy. Soc. Victoria, vol. xxix., (n.s.), pt. i., 1916, p. 99, pl. v., figs. 47, 48.

2 Bull. Buffalo Soc. Nat. Sci., vol. xi., No. 1, 1914. Description of some New Siluric Gasteropods, pp. 93-101, 1 plate.

plant *Bythotrephis lesquereuxi*, together with a few water-worn specimens of *Orthoceras*. The writer has elsewhere¹ discussed at length the significance of this unique fauna and biogenic conditions which it indicates. The very thin shell of these pulmonate gastropods may be taken as a slight bit of additional evidence to that given in the paper above referred to in support of the view that the Bertie waterlime was deposited not in marine water, but in brackish or fresh water, and that the *Hercynellas*, as well as eurypterids, were carried into the Bertie muds by the rivers. If, on the other hand, *Hercynella* is to be regarded as a marine genus, then we have here another case of intermingling of marine and fluviatile species in the region of deposition at their junction."

The sediments in which the Yeringian (newer Silurian) fossils are found in the Upper Yarra district are mudstones. This fossil collection was made prior to 1856 by the Geological Survey of Victoria, the locality number being B 23, and the exact position, near Stewart's station, at the junction of the Woori Yallock Creek and the Yarra River. These mudstones are olive-brown in colour, varied with dark grey streaks, and distinctly micaceous. The structure appears to indicate that the rock was either deposited in shallow water or in areas subjected to currents. From the occurrence of corals and gasteropods in this fauna one is inclined to infer that the water was not very shallow, but that periodic incursions of mud took place. That there may also have been a fair amount of decaying matter brought down to this area by streams is evident from the abundance of ostracods (*Beyrichia*), for these little crustaceans probably fed on the drifted weed and similar pabulum.

The following is a list of fossils associated with *Hercynella victoriae* in the mudstone at the junction of the Woori Yallock and the Yarra :—

Coral—

Lindstroemia, sp.

Worm—

Trachyderma cf. *squamosa*, Phillips.

Polyzoan—

Fenestella margaritifera, Chapm.

Brachiopods—

Camarotoecia, sp.

Nucleospira australis, McCoy.

Orthis actoniae, Sow.

1 Bull. Geol. Soc. America, vol. xxiv., 1913, pp. 499-515.

Strophomena ?antiquata, Sow. sp.

Stropheodonta (Leptostrophia) alata, Chapm.

Bivalves—

Conocardium bellulum, Cresswell sp.

Mytilarca acutirostris, Chapm.

Nuculites maccoyanus, Chapm.

Palaeoneilo varicostae, Chapm.

Gasteropods—

Bellerophon fasciatus, Lindström.

Plautotomaria maccoyi, Chapm.

Conularia sowerbii, DeFr.

Cephalopod—

Orthoceras lineare, Münster sp.

Trilobites—

Lichas australis, McCoy.

Odontopleura jenkinsi, Eth. fil. and Mitch.

Odontopleura rattei, Eth. fil. and Mitch.

Phacops sweeti, Eth. fil. and Mitch.

Ostracods—

Beyrichia kloedeni, McCoy.

Beyrichia kloedeni, var. *granulata*, Jones.

Beyrichia wooriyallockensis, Chapm.

Beyrichia ligatura, Chapm.

Beyrichia maccoyanus, Jones, var. *australiae*, Chapm.

Cirripede—

Turrilepas cf. yeringiae, Chapm.

It has been suggested by Miss O'Connell, in the case of the Waterlime *Hercynellas* that being thin-shelled they probably lived under fresh or brackish-water conditions, and were subsequently swept by rivers into the sea. Our Victorian species is, like the Waterlime fossils, apparently thin in texture, but the perfect condition of the cast of the figured type is so striking as to preclude the idea of its having drifted into the marine mud.

The absence of eurypterids from the Yeringian, and, with one exception, all ceratiocarids, both groups of which are so common in the Waterlime series of North Buffalo, is additional evidence in favour of a marine origin for the Victorian Yeringian deposits. The same cannot be said, however, of the Melbournian sediments, whose fauna contains a *Pterygotus* and numerous ceratiocarids.

That the mudstone of locality B 23 is of marine origin is evident from the fairly large assemblage of brachiopods, bivalves and gasteropods which it contains. The thin-shelled condition, not only of



Hercynella, but of the molluscs and brachiopods occurring in the Victorian Yeringian, seems, therefore, entirely due to the fact that the waters were frequently rendered turbid by the periodic discharge of terrigenous material by rivers, and possibly also by coast erosion, a condition which acts severely on lime-secreting organisms, a fact that can be proved by examining the shore-faunas of land-locked and mud-swept bays at the present time.

The conclusions drawn from the above data are:—

- 1.—That the *Hercynellas* of the Victorian Yeringian were of marine habits, as proved by the associated fauna.
- 2.—That the sediments of locality B 23, in which *Hercynella* occurs, were laid down under fairly deep-water marine conditions, but the areas of sedimentation may have been periodically subjected to invasions of mud brought down by rivers.
- 3.—That the lime-secreting fauna of the Yeringian mudstones tends to prove, by the thin shells, that the terrigenous element in the Yeringian sea was so marked as to considerably lower the amount of carbonate of lime available to those organisms.